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GORDON CONFERENCE ON PHYSICAL METALLURGY (1983) 20-24

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JUNE 1983 HOLDERNESS SCHOOL NEW HAMPSHIRE(U) RHODE

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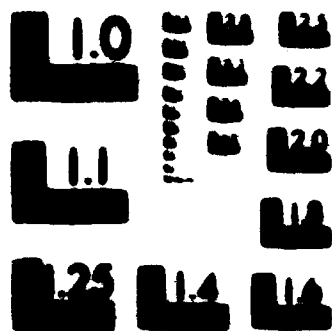
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GORDON RESEARCH CONFERENCE ON PHYSICAL METALLURGY, 20-24 June, 1983,  
Holderness School, New Hampshire

*High Temperature deformation, microstructural changes, deformation,  
alloys.*

The topic chosen for the 1983 Gordon Conference on Physical Metallurgy was "High Temperature Deformation" with the emphasis of the presentations being on large strain deformation and microstructure effects. Over one hundred scientists attended the conference, with 21 of them being from outside the United States, mostly from Europe. The quality of the presentations was uniformly excellent, prompting stimulating discussion periods with an extensive exchange of ideas for new approaches and research opportunities.

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1983 GORDON CONFERENCE  
on  
PHYSICAL METALLURGY

June 20-24, 1983  
Holderness School  
New Hampshire

FINAL REPORT

Neil Paton  
Chairman



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## **GORDON RESEARCH CONFERENCE**

### **Physical Metallurgy**

**Malvernese School, Plymouth, N. H.**

**June 20-24, 1963**

The topic chosen for the 1963 Gordon Conference on Physical Metallurgy was "High Temperature Deformation" with the emphasis of the presentations being on large strain deformation and microstructure effects.

Over one hundred scientists attended the conference, with 21 of them being from outside the United States, mostly from Europe. The quality of the presentations was uniformly excellent, prompting stimulating discussion periods with an extensive exchange of ideas for new approaches and research opportunities.

The subject of microstructural changes occurring during high temperature deformation was discussed at considerable length during the conference, particularly during the first two days. Formal presentations and detailed discussions led to a clear conclusion that a theory is needed describing nucleation and growth of new grains forming during dynamic recrystallization. The theory is required to understand high temperature deformation processes occurring during hot working and superplastic forming of metals. At present individual researchers are using independent experimental methods to examine these phenomena such as microstructural examination, flow stress measurements, torsion tests, etc., but there is a clear need to tie these methods together in a unified study combined with a satisfactory theoretical model.

Other significant technical issues coming out of the talks and discussions at the conference were a need to better understand flow in multi-phase systems and alloys. This was borne out in talks by Ghosh and Raj on superplasticity, and in the talks by Pharr and Seery on deformation of solid-liquid systems. Problems in understanding powder consolidation are also of a similar nature as discussed by Euser and Arst. Most commercially important alloys are multi-phase, making an understanding of their high temperature deformation of paramount importance.

Other subjects which generated considerable interest and clearly qualify as being candidates for further research in the future were a talk on ordered alloys by C. Liu of Oak Ridge National Laboratory, and acoustic emission phenomena at high temperatures as presented by K. Ono of UCLA. A new experimental method of observing deformation in situ at high temperatures also resulted in considerable interest. This method, discussed by C. Hammond of Leeds University, involves the use of an electron emission microscope to observe deformation and phase changes at high temperatures.

Attachments to this report include a copy of the conference program (Attachment "A") and a list of attendees (Attachment "B").

In summary, the conference was well attended and enthusiastically received. The availability of assistance with travel expenses enabled many scientists to take part in the conference who would otherwise have been unable to attend. A total of 12 attendees received some form of financial aid, and although limited funds are made available by the Gordon Research Conferences, the sum is not adequate for the level of support required to ensure a broad ranging and successful conference.

**1983 GORDON CONFERENCE ON PHYSICAL METALLURGY**  
**June 28-30 Maidness School, Plymouth, N.H.**  
**TOPIC: HIGH TEMPERATURE DEFORMATION**

**CONFERENCE CHAIRMAN: Neil Peden**

**VICE-CHAIRMAN: Didier Defontaine**

**Monday, June 28, 1983**

**SESSION I - MORNING**  
**MICROSTRUCTURE DEVELOPMENT**

**Session Chairman:**

**E. Raa**

**University of Trondheim**  
**Norway**

- 8:30 - 9:30 a.m.**      **THE EVOLUTION OF MICROSTRUCTURE DURING HIGH TEMPERATURE DEFORMATION:**  
**R. Matherly, University of New South Wales,**  
**Manington, NSW, Australia**
- 9:30 - 10:30 a.m.**      **A NEW MODEL FOR DYNAMIC RECRYSTALLIZATION**  
**J. J. Jones , McGill University, Montreal, Canada and**  
**T. Sakai, University of Electro-Communications**  
**Tokyo, Japan**
- 10:30 - 11:00 a.m.**      **-----BREAK-----**
- 11:00 - 11:30 a.m.**      **DYNAMIC RECRYSTALLIZATION OF SINGLE CRYSTALS**  
**G. Gottstein, University of Aachen**  
**Germany**
- 11:30 - 12:00 noon**      **DISCUSSION**

**SESSION I - EVENING**  
**MICROSTRUCTURE DEVELOPMENT**

**Session Chairman:**

**J. Hirth, Ohio State University**  
**Columbus, Ohio**

- 8:00 - 9:00 p.m.**      **THE EVOLUTION OF MICROSTRUCTURE DURING DYNAMIC RECRYSTALLIZATION**  
**J. Humphreys, Imperial College,**  
**London, England**
- 9:00 - 10:00 p.m.**      **GRAIN SIZE DISTRIBUTION EFFECTS ON HIGH TEMPERATURE FLOW:**  
**R. Raj, Cornell University,**  
**Ithaca, N.Y.**

**1983 GORDON CONFERENCE ON PHYSICAL METALLURGY  
June 20-24 Waldenwood School, Plymouth, N.H.  
TOPIC: HIGH TEMPERATURE DEFORMATION**

**Tuesday, June 21, 1983**

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**SESSION II - MORNING  
HIGH TEMPERATURE FLOW**

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**Session Chairman:  
J. Tien  
Columbia University  
New York, N.Y.**

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- 8:30 - 9:30 a.m.**      **SOLUTION HARDENING AND STRAIN HARDENING AT ELEVATED TEMPERATURES:**  
H. Kesting, Technische Universität Hamburg-Harburg, G.  
Garnsey and P. Parks, Los Alamos Scientific Laboratory  
Los Alamos, New Mexico
- 9:30 - 10:30 a.m.**      **MICROSTRUCTURE EVOLUTION AND FLOW LOCALIZATION AT ELEVATED TEMPERATURE:**  
A. Ghosh, Rockwell International  
Thousand Oaks, Ca.
- 10:30 - 11:00 a.m.**      -----**DEAL**-----
- 11:00 - 11:30 a.m.**      **FRACTURE IN MULTIAXIAL DEFORMATION**  
H. Rahn and G. Pitschmann, University of Pittsburgh  
Pittsburgh, Pa.
- 11:30 - 12:00 noon**      **DISCUSSION**
- 5:00 - 6:00 p.m.**      **POSTER SESSION**

**SESSION II - EVENING  
HIGH TEMPERATURE FLOW**

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**Session Chairman:  
S. Mukher  
Los Alamos Scientific Laboratory  
Los Alamos, New Mexico**

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- 8:00 - 9:00 p.m.**      **STRUCTURAL BASIS FOR CONSTITUTIVE EQUATIONS:**  
C. Hartley, Louisiana State University,  
Baton Rouge, La.
- 9:00 - 10:00 p.m.**      **MEASUREMENTS OF DYNAMIC CONSTITUTIVE RELATIONS AT HIGH STRAIN RATES:**  
D. Hoehle, SRI  
Menlo Park, Ca.



**1983 GORDON CONFERENCE ON PHYSICAL METALLURGY  
June 26-28 Maidmoss School, Plymouth, N.H.  
TOPIC: HIGH TEMPERATURE DEFORMATION**

**Wednesday, June 22, 1983**

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**SESSION III - MORNING  
HIGH TEMPERATURE FLOW AND FRACTURE**

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**Session Chairman:**  
**G. Boudalet,**  
**Institut National Polytechnique**  
**Saint Martin d'Heres**  
**Grenoble, France**

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- 8:30 - 9:30 a.m.** **ENVIRONMENTAL EFFECTS ON HIGH TEMPERATURE DEFORMATION AND BRITTLENESS:**  
**R. Oricknell and G. Woodford, General Electric**  
**Albany, New York**
- 9:30 - 10:30 a.m.** **CAVITATION IN HIGH TEMPERATURE DEFORMATION:**  
**A. Argon, MIT**  
**Cambridge, Mass.**
- 10:30 - 11:00 a.m.** -----BREAK-----
- 11:00 - 11:30 a.m.** **CONCURRENT EFFECTS ON CAVITATION:**  
**P. Anderson, and J. Rice, Harvard University**  
**Cambridge, Mass.**
- 11:30 - 12:00 noon** **DISCUSSION**
- 1:00 - 6:00 p.m.** **POWER SESSION**

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**SESSION III - EVENING  
HIGH TEMPERATURE FLOW AND FRACTURE**

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**Session Chairman:**  
**P. Wray, U.S. Steel Corporation**  
**Pittsburgh, Pa.**

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- 8:00 - 9:00 p.m.** **BRITTLENESS OF STEELS BETWEEN 600-1000°C**  
**H. Suzuki, Nippon Steel**  
**Osaka, Japan**
- 9:00 - 10:00 p.m.** **CHEMISTRY, PROCESSING AND MICROSTRUCTURE EFFECTS IN HIGH TEMPERATURE FLOW OF STEELS:**  
**L. Gaddy, U. S. Steel Corporation**  
**Pittsburgh, Pa.**

1983 GORDON CONFERENCE ON PHYSICAL METALLURGY  
June 20-24 Wadsworth School, Plymouth, N.H.  
TOPIC: HIGH TEMPERATURE DEFORMATION

Thursday, June 23, 1983

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SESSION IV - MORNING  
MULTIPHASE SYSTEMS

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Session Chairman:  
H. Ma, Stanford University  
Stanford, Ca.

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- 8:30 - 9:00 a.m. PLAN OF LIQUID-SOLID SYSTEMS:  
G. Pharr, Rice University  
Houston, Texas
- 9:00 - 9:30 a.m. DEFORMATION OF SEMI-SOLID METALLIC SYSTEMS  
H. Sany, Institut Nat'l Polytechnique de Grenoble  
Grenoble, France
- 9:30 - 9:45 a.m. DISCUSSION
- 9:45 - 10:00 a.m. -----BREAK-----
- 10:00 - 11:00 a.m. MODELLING OF POWDER CONSOLIDATION AT HIGH TEMPERATURES  
1. Powder Consolidation under Pressure (Arzt)  
2. Powder Consolidation under Capillary Forces (Einer)  
H. Einer and E. Arzt, Max Planck-Institut für  
Metallforschung  
Stuttgart, Germany
- 11:00 - 11:15 a.m. DISCUSSION
- 11:15 - 12:00 noon MECHANICAL PROPERTIES OF DUCTILE INTERMETALLIC ALLOYS  
C. Liu, Oak Ridge National Laboratory  
Oak Ridge, Tenn.

SESSION IV - EVENING

- 8:30 - 9:30 p.m. MODELS FOR THE FORECASTING OF GREAT EARTHQUAKES  
Stephen Kirby, US Geological Survey  
Reno Park, CA

1983 GORDON CONFERENCE ON PHYSICAL METALLURGY  
June 20-24 Wadsworth School, Plymouth, N.H.  
TOPIC: HIGH TEMPERATURE DEFORMATION

Friday, June 24, 1983

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SESSION V - MORNING  
HIGH TEMPERATURE FLOW & FRACTURE

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Session Chairman:  
R. Paton, Rockwell International  
Pittsburgh, PA.

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8:30 a.m.

**INFLUENCE OF PARTICLE DISPERSIONS ON RECRYSTALLIZATION  
AND GRAIN GROWTH**

E. Eke, University of Trondheim  
Norway

**INFLUENCE OF SECOND PHASE PARTICLES ON HIGH TEMPERATURE  
DEFORMATION OF ALUMINUM ALLOYS:**

D. Lloyd, Alcan  
Kingston, Ontario

**CHARACTERIZATION OF HIGH TEMPERATURE TRANSFORMATIONS AND  
DEFORMATION USING ELECTRON BESSION MICROSCOPY**

C. Hammond, Leeds University  
Leeds, England

-----BREAK-----

**ACOUSTIC EMISSION AT ELEVATED TEMPERATURE**

K. Cho, University of California  
Los Angeles, Ca.

**ELEVATED TEMPERATURE FATIGUE CRACK GROWTH IN TITANIUM  
ALLOYS:**

J. C. Williams, and J. E. Allison, Mellon Institute and  
Carnegie Mellon University  
Pittsburgh, Pennsylvania

**STRESS STATE INFLUENCES ON CAVITATION DEVELOPMENT IN A  
SUPERPLASTIC ALUMINUM ALLOY:**

C. Hamilton, Rockwell International  
Thousand Oaks, Ca.

**1968 GORDON CONFERENCE ON PHYSICAL METALLURGY**  
**June 20-24 Coldwater School, Plymouth, N.H.**  
**TOPIC: HIGH TEMPERATURE DEFORMATION**

**POSTER SESSIONS**

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**June 21 - 22, 1968 8-6 P.M.**

**FLOW IN AN ULTRA-FINE GRAIN NICKEL BASE ALLOY:**  
J. E. Gregory, Technische Universität Hamburg-Harburg,  
U. Conway, and H. D. Dix, Stanford University  
Stanford, Ca.

**SMALL-ANGLE X-RAY SCATTERING STUDY OF HIGH  
TEMPERATURE DEFORMATION AND FRACTURE:**  
H. H. Yoo, Oak Ridge National Laboratory  
Oak Ridge, Tenn.

**HIGH TEMPERATURE DEFORMATION OF POLYCRYSTALLINE MgZn:**  
E. Wright, Rensselaer Polytechnic Institute  
Troy, New York

**THE ROLE OF VORTEXES DURING ELEVATED TEMPERATURE LOW  
CYCLE FATIGUE:**  
S. J. Gensel, University of Rochester  
Rochester, NY

**DELEGATION CORE EFFECTS ON YIELDING IN MgAl:**  
S. P. Papp, University of Pennsylvania  
Philadelphia, PA

**TEXTURE DEVELOPMENT AND LENGTH CHANGES DURING HIGH  
TEMPERATURE TENSION:**  
F. Ruchonnet, CNRS,  
France

**GRANULAR GROWTH IN ZrTi ALUMINIDE:**  
P. Remmonet and R.M.A. Pellen, NET  
Cambridge, MA

**GRANULAR GROWTH IN NICKEL-BASE SUPER ALLOYS:**  
R.M.A. Pellen, and K. Geln, NET  
Cambridge, MA

**COMPUTER SIMULATION OF HOT ISOSTATIC PRESSING:**  
T.B. Bhat, Ministry of Defense, Metallurgical Research Lab,  
India

Dr-Gunn  
Dr-Gunn  
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-6-  
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